A CASE SERIES OF METAPHYSEAL FRACTURES OF THE TIBIA MANAGED WITH HYBRID EXTERNAL FIXATOR APPLICATION AS AN EARLY DEFINITIVE PROCEDURE

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ABSTRACT

BACKGROUND

Fractures of proximal and distal metaphyseal tibia have historically been difficult to treat. Because of proximity of these fractures to the articular surfaces, getting good fixation, stability and regaining full joint motion and function may be difficult. Soft tissue damage, comminution, fracture extension into the knee or ankle joint lead to unsatisfactory results in many cases regardless of the treatment modality. Hybrid fixation is a single definitive procedure for metaphyseal tibia fractures, which have the ability to manage compound and comminuted fractures, which have good fracture union with minimum complications. Duration of study from November 2006 to November 2008 was conducted at Department of Orthopaedics and Traumatology, Madurai Medical College, Madurai. Total of 36 patients were included in this study, out of which 34 patients obtained bony union with good outcome. One patient went for below knee amputation due to septicemia.

The aim of the study was to evaluate clinical, functional and radiological outcome after hybrid fixator application for metaphyseal fracture of tibia as a single definitive fixation.

MATERIALS AND METHODS

36 patients were included in this study. Among the 36 cases, 34 males and 2 females were included. Duration of study from November 2006 to November 2008 was conducted at Department of Orthopaedics and Traumatology, Madurai Medical College, Madurai.

Study Design- A prospective study.

RESULTS

We followed the Rating System of NEER for evaluation of knee and Tornetla et al scoring 39 for evaluation of ankle. According to this score 52% of patients had excellent results, 31% of patients had good results and 17% of patients had fair results at final follow-up. One patient had poor result. Out of 36 patients, 35 patients had a good fracture union at end of follow-up.

CONCLUSION

Hybrid external fixator is a very effective and useful treatment modality for metaphyseal fractures of tibia. It helps in providing good skin care and it is easy for application of flap cover. It achieves good fracture union, thereby avoiding multiple surgeries.

KEYWORDS

Hybrid Fixator, NEER Score, Metaphysis, Tornetla Score.

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BACKGROUND

Metaphyseal fractures are high energy fractures, usually associated with extremely damaged soft tissues leading to increased incidence of complications following open reduction and internal fixation. Also, comminution of metaphysis and articular surface with small fragments makes anatomical reduction and stable internal fixation difficult. The resulting incongruity of articular surface leads to early secondary osteoarthritis.

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In our study, we have used hybrid external fixator application for all grades of proximal and distal tibia fractures, which has two separate components: 1. Ring fixator and 2. AO external fixator to assess the strength as done in previous studies.^{1,2,3,4} It is a minimally invasive procedure which allows good preservation of soft tissues and early mobilisation of adjacent joint.

Conservative treatment with POP has high incidence of malunion, stiffness, thromboembolic disease and pneumonia. ORIF with plate osteosynthesis has high chance of skin necrosis and infection leading to malunion and implant failure. Intramedullary devices give inadequate stability. Compound injuries, initial treatment with external fixator application followed by definitive internal fixation. These multiple procedures increases the economical and mental stress for the patients and has its own advantages which was proved in previous studies.^{3,5}

But hybrid fixation is a single definitive procedure, helping both in wound care and aiding in sound union of fracture site. They also offer advantages of applying multiple

pins according to varying fracture pattern without disturbing the soft tissue cover.

Aim of the Study

To evaluate clinical, functional and radiological outcome after hybrid fixator application for metaphyseal fracture of tibia as a single definitive fixation.

MATERIALS AND METHODS

36 patients were included in this study. Among the 36 cases, 34 males and 2 females were included. Study conducted at Department of Orthopaedics and Traumatology, Madurai Medical College, Madurai.

Study Design

A prospective study.

Inclusion Criteria

All grades of proximal and distal metaphyseal tibial fractures.

Exclusion Criteria

All pathological fractures and fractures in children were excluded from this study.

Investigations

All the patients were examined clinically and radiologically, especially proximal tibia fracture should be looked for peripheral pulses. Good quality x-ray in two perpendicular views. CT scan with two and three dimensional reconstructions if necessary. Basic blood investigations should be done for all the cases.

Implants

Ring system which consists of K wires, wire fixation bolts, 5/8th ring, bolts, nuts and posts and pin system which consists of Schanz screw, AO tube and universal clamp and interconnecting system.

Implants Used

Surgical Procedure

Metaphyseal fragment is fixed with two ilizarov wires and connected to a 5/8th ring. For additional stability, an extra wire can be added. Tensioned ilizarov wires in metaphyseal fragments gives good hold and stability than screws. It also gives multiplanar fixation and aids in early joint mobilisation.

In case of periarticular fractures of tibia extending to diaphysis, 3 Schanz screws are inserted in proximal fragment and three Schanz screws in distal fragment to give adequate stability to the fracture site.

Two AO rods are connected to the 5/8th ring and are triangulated. Triangulation gives 30-degree stability, which are comparable to a full ring. For additional stability, an additional rod can be used.

Articular surface reduced with closed percutaneous screw fixation if possible to maintain articular congruity.

Postoperative Protocol

Second Post-Op Day

ROM exercises started along with quadriceps exercises. Partial weight bearing started if bone grafting not done and delayed till 6 weeks if grafted for settling of graft.

After 6 Weeks

Full weight bearing started after radiological signs of union appear and fixator removed after fracture is united radiologically. Regular check-up is done for half pin pull out, loss of wire tension, deformity in half pins.

Evaluation of Outcome

Result	Score
Excellent	16-20
Good	12-16
Fair	8-12
Failure	4-8
We followed the Rating System of NEER for Evaluation of Knee	

Grade	Pain	ROM	Angulation
Excellent	None	Dorsiflexion > 5 Plantar flexion > 30	< 3
Good	Intermittent	Dorsiflexion 0-5 Plantar flexion 20-30	3-5 valgus < 3 varus
Fair	Limiting daily activities	Dorsiflexion > -5 to 0 Plantar flexion 15-20	5-8 valgus 3-5 varus

Poor	Intractable	Dorsiflexion < -5 Plantar flexion < 15	> 8 valgus > 5 varus
<i>We followed Tornetta et al Scoring 39 for Evaluation of Ankle</i>			

RESULTS

Age Group	No. of Patients	Percentage
20 - 30 years	6	16.7%
30 - 40 years	22	61%
40 - 50 years	6	16.7%
50 - 60 years	2	5%
Age Distribution		

Sex	Right	Left	Percentage
Male	20	14	56%
Female	0	2	44%
Total	20	16	100%
Side of Injury			

Site	No. of Cases	Percentage
Proximal tibia	18	50%
Distal tibia	18	50%
Anatomy		

Mode of Injury	No. of Cases	Percentage
RTA	36	100%
Fall	0	0%
Mode of Injury		

ASSOCIATED INJURIES

Head injury- 2

Distal radius fracture- 1

Patella fracture- 4

Supracondylar fracture femur- 1

Type	No. of Cases	Percentage
Simple	10	28%
Compound GR II	4	11%
Compound GR IIIA	8	22%
Compound GR IIIB	14	39%
Type of Fractures		

Time of Union	No. of Cases	Percentage
< 4 months	22	66%
4-6 months	8	23%
> 6 months	4	11%
Time of Union		

Analysis of Functional Outcome

Functional assessment score is mentioned above for both ankle and knee. According to the score, the overall results are-

Grading	No. of Cases	Percentage
Excellent	18	54%
Good	10	29%
Fair	6	17%
Overall Results		

Cases

First case simple proximal tibia fracture right side, Schatzker type VI.

Preoperative X-Ray *Postoperative X-Ray***Range of Movements** *Second Case Compound Grade III B Distal Tibia Fracture Right* *Preoperative Wound* *Postoperative X-Ray*

Flap Cover *4-Month Follow-Up* *Follow-Up Clinical Photo*

Third Case Simple Fracture Proximal Tibia Schatzker Type VI.

*Preoperative Status**Preoperative X-Ray* *Postoperative X-Ray* *Functional Outcome*

Fourth Case Fracture Distal Tibia Left Compound Grade IIB.

Preoperative X-Ray *Postoperative X-Ray* *3-Month Review X-Ray* *Functional Outcome*

DISCUSSION

All the methods available for fixation of metaphyseal fractures of tibia have good fracture union results, but they do not address all of its problems. Soft tissue management becomes the important criteria in the treatment of these fractures, since it preserves the haematoma helping in quick fracture healing. The compliance of hybrid fixator is better than ilizarov fixator.

In our studies 36 cases of which 26 are compound cases 10 are simple cases, all of which were taken for surgery immediately after admission. All the cases were followed for a mean period of 14.2 months averaging from 28 months to 4 months. Out of 36 cases, bony union was obtained in 34 cases and 2 patients went for below knee amputation. 4 cases had delayed union, one of which was treated by prolonged PTB cast and one with fibulectomy.

Barberie et al⁽⁶⁾ reported 3 non-union in 34 patients managed by hybrid fixator. Tracy et al⁽⁷⁾ reported one case of non-union in 31 patients. No non-union out of 13 cases in a series by Kevin J Pugh.⁽⁸⁾ The average time of union was 4.5 months compared to 4 months by Barberi et al and 4.2 months by Tornetta et al.⁽⁹⁾

Among the 36 cases, 8 cases got pin tract infection and settled without surgical intervention. There were 4 cases of deep infection, one patient was treated by antibiotics. Other patient presented lately after union in the site of TBW applied for patella, which settled after removal of implant.

4 patients had knee stiffness. One patient had knee instability, which persisted after union of fracture which was treated conservatively with knee brace. Two patients had 2 cm shortening. They were managed with heel rise.

CONCLUSION

Hybrid external fixator is very effective and useful treatment modality for metaphyseal fractures of tibia. It helps in providing good skin care and it is easy for application of flap cover. It achieves good fracture union, thereby avoiding multiple surgeries. It is a modular, safe and useful treatment

option for metaphyseal fractures of tibia. It is minimally invasive with least complications compared to other methods.

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